

# **Conquering** **Thermodynamics**

Systems, Surrounding and Boundaries

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**<https://www.knowledgetohumanity.blogspot.com>**

➤ **My other articles:-**

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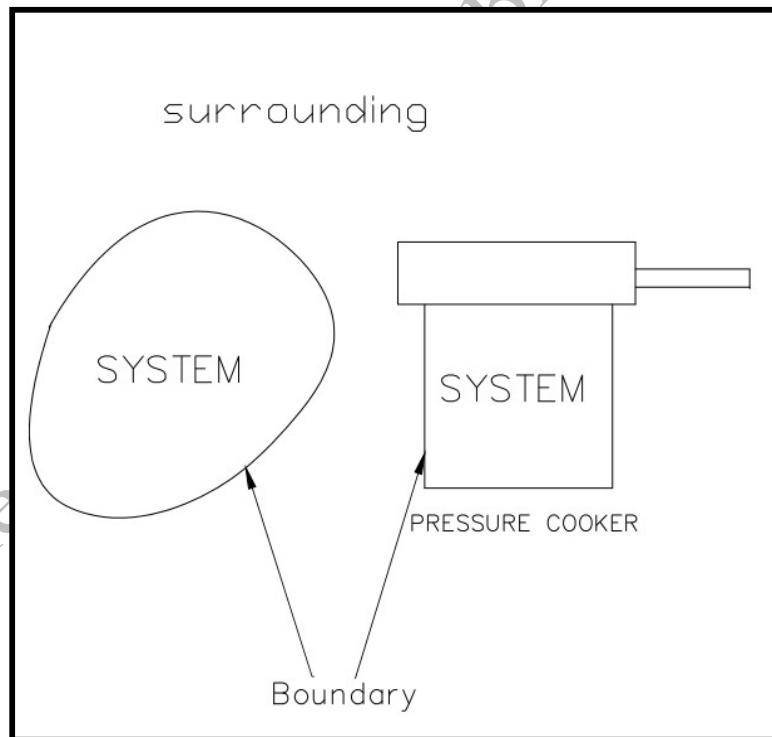
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## Thermodynamics:-

**Thermodynamics is a branch of science which deals with study of energy and its conversion from one form to another.**

### Few terms related to thermodynamics



➤ **System:-**

Selected quantity of matter for thermodynamic study is called system.

➤ **Surrounding:-**

Everything outside system is called surrounding.

➤ **Boundary:-**

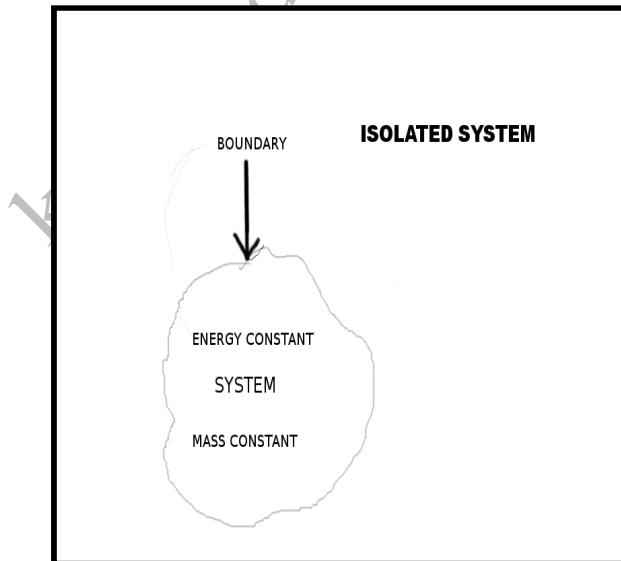
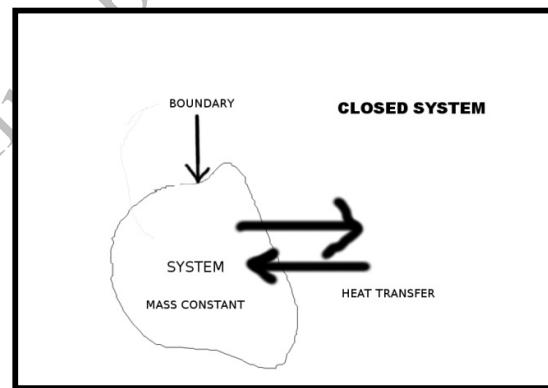
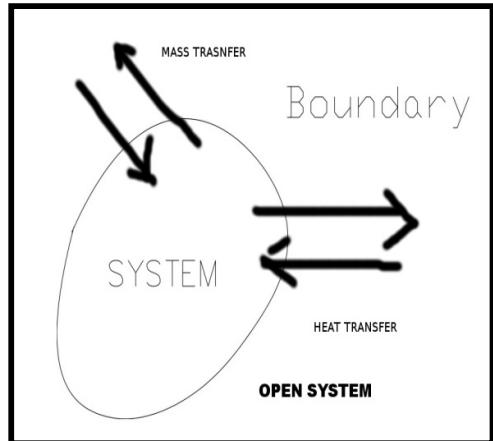
The real or imaginary surface that separate system and surrounding is called boundary.

➤ **Universe:-**

Combination of system, boundary and surrounding is called universe.

## System Types

- 1. Open System**
- 2. Closed System**
- 3. Isolated System**



## Types of Boundaries

There are many boundary types like real, imaginary, movable, fixed etc. but these are described by their names itself.

The things to understand are **Diathermal** and **Adiabatic** boundaries

**Diathermal wall:** - Boundary which permits flow of energy across system and surroundings is called diathermal wall.

For example - pressure cooker body

**Adiabatic wall:** - Boundary which does not permit flow of energy across system and surroundings is called adiabatic wall.

For example - insulated walls of refrigerator

**Note:** - In real life 100% adiabatic wall is not possible.

## Some thermal properties

There are many properties but for instance we will consider following

### **Enthalpy**

Enthalpy is summation of internal energy  $U$  and flow work rate i.e. (pressure and volume)

$$H = U + PV$$

Unit is Joule

### **Entropy**

Entropy is amount of disorderness of system or degree of freedomness of system.

## **Thermodynamic work**

It is defines as energy transferred without transfer of mass across system boundaries because of intensive properties other than temperature.

## **Thermal equilibrium**

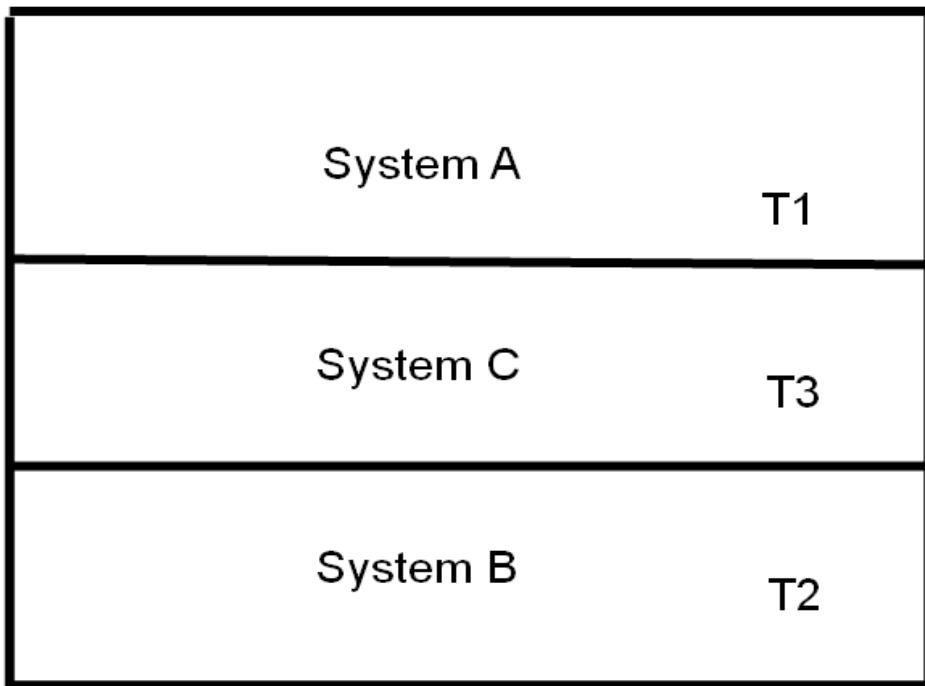
When system experiences no change in all its properties it is said to be in thermal equilibrium.

## **Basic laws of thermodynamics**

- **Zeroth law**
- **First Law**
- **Second Law**
- **Third law**

# Basic laws of thermodynamics

## Zeroth law



When two systems are in thermal equilibrium with a third system, they are also in thermal equilibrium with each other.

As shown in figure,

System A is in thermal equilibrium with system C

And system B is in thermal equilibrium with C,

Therefore system A is in thermal equilibrium with B.

## First Law

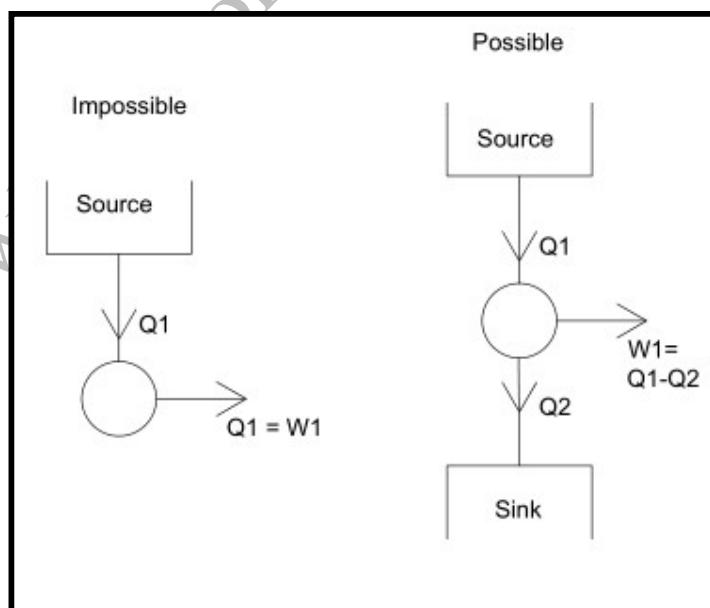
When a system is in thermodynamic cycle, heat energy supplied to system is equivalent to work done by the system.

In short, Energy can be converted from one form to another; it neither can be created nor destroyed.

## Second Law

Second law is indebted with two statements i.e. **Kelvin Plank and Clausius statements.**

### **Kelvin Plank Statements**

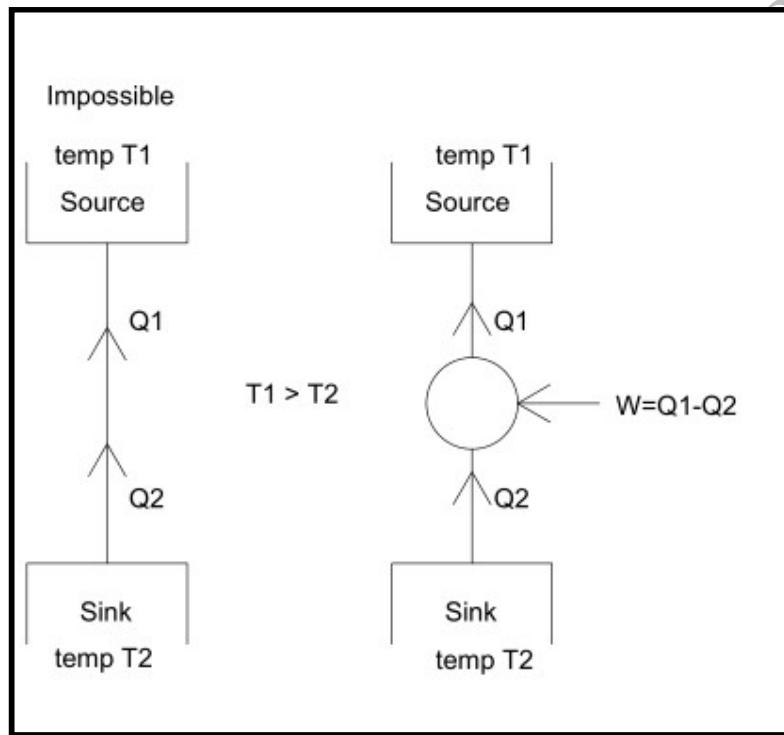


“It is impossible for cyclic engine to receive heat

energy from same one heat reservoir and give equivalent work. “

There are some losses always in some or other form.

## Clausius Statements



“It is impossible to create a cyclic engine which transfers heat from low temperature heat reservoir to high temperature reservoir without any external aids (help). “

## Third law

“It is impossible to achieve 0 K (Zero Kelvin) temperatures “

Because to achieve 0 k temperature we need a body with temperature less than that (as heat transfers from high temp to low temp) which is impossible.

Extensive use of open source softwares has been done while preparing this article

**Open Office** is used for writing this article

**Librecad** and **GIMP** are used to create figures related to content.

My article on Open Source Softwares  
(<http://goo.gl/1V5YQx>)

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